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Model design to predict forest fire risk in Navarra (Spain) using time series analysis

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Understand and predict how forest fire potential changes over time are essential for prioritizing forest management activities and reducing damage. Nowadays we lack the capacity to predict future forest fire trends in response to climate change. The main goal of this research is to build an empirical model to describe, estimate and forecast the forest fires dynamics using the improved Fire Potential Index (FPI) (Huesca et al., 2007) as indicator of fire.

The study region is the Navarra Autonomic Community, situated in the North-West part of the Iberian Peninsula. This region is divided into three bioclimatic regions: Mediterranean, Atlantic and Alpine. Each region shows distinct forest fire behaviour. The study period lasts from February 2000 to December 2006. The year 2007 was used in the validation process.

The FPI is a dynamic Forest Fire Potential Index based on fuel characteristics and moisture status. The FPI uses the extinction moisture from fuel type map, the ten-hour time lag dead fuel moisture from meteorological data (temperature and relative moisture) and green vegetation percentage from Relative Greenness Vegetation Index. The latter variable depends on NDVI in Mediterranean region whereas in Atlantic and Alpine regions depends on NDWI.

The model is based on temporal evolution of improved FPI, used to understand the past role of fire. Time series analysis was use to assess quantitatively temporal behaviour of

the Fire Potential Indexes. Autoregressive models were used to model the dynamics of the improved Fire Potential Indexes in the three bioclimatic regions. In each case, the usual model selection criteria AIC and SBC were used to selected between alternative models. Model adequacy was established by means of the Ljung-Box Q statistic.

Research results show that improved FPI´s dynamics are adequately represented by an autoregressive model which included short and long-term FPI information. Each bioclimatic region is represented by a different model. In addition, the model presented can be used as indicator to future forest fire riskiest areas which can have significant implications for defining management strategies.

Huesca, M., Palacios - Orueta, A., Montes, F., Sebastián, A., Escribano, P. (2007): "Forest Fire Potential Index for Navarra Autonomic Community (Spain)" 4th International Wildland Fire Conference, Seville (Spain) 13-17 May 2007.